

52. $\lim_{x \rightarrow \infty} x \sin \frac{1}{x} = 1$

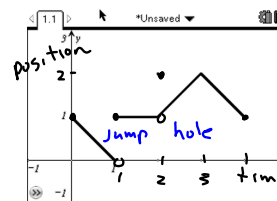
let $x = \frac{1}{v}$ as $x \rightarrow \infty$
 $v = \frac{1}{x}$ $v \rightarrow 0$

$\frac{1}{v} \sin v$

$\lim_{v \rightarrow 0} \frac{\sin v}{v} = 1$

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2.3 Continuity



continuous at
 $x=3$? yes

Where is the function discontinuous?

1. $\lim_{x \rightarrow 3} f(x) = 2$
2. $f(3) = 2$
3. $2 = 2$

- $x=1$ $x=2$
1. $\lim_{x \rightarrow 2} f(x) = 1$
 2. $f(2) = 2$
 3. $1 \neq 2$

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definition of continuity at a point

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 $f(x)$ is continuous at $x=c$ if

1. $\lim_{x \rightarrow c} f(x)$ exist
2. $f(c)$ exists
3. $\lim_{x \rightarrow c} f(x) = f(c)$

definition of continuity on an interval

$f(x)$ is continuous on an interval if
 $f(x)$ is continuous at each point in
the interval

type of discontinuities

hole (removable discontinuity)



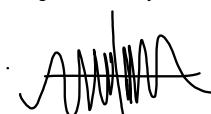
jump discontinuity



infinite discontinuity



oscillating discontinuity



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p81 exploration 1 removing a discontinuity

$$f(x) = \frac{x^3 - 7x - 6}{x^2 - 9} \quad x \neq 3 \quad x \neq -3$$

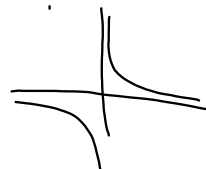
new $f(x) = \begin{cases} \frac{x^3 - 7x - 6}{x^2 - 9} & x \neq 3, x \neq -3 \\ k & , x = 3 \end{cases}$

find k

$$\lim_{x \rightarrow 3} \frac{(x-3)(x+1)(x+2)}{(x-3)(x+3)} = \frac{10}{3} \quad k = \frac{10}{3}$$

continuous on the domain ? yes

$$f(x) = \frac{1}{x}$$

not cont. at $x=0$ but $x=0$ is not in the domain of $y = \frac{1}{x}$

intermediate value theorem for continuous functions

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